American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

Flight Activity and Population Dynamics of the Olive Psylla, *Eupyllura olivina* Costa [Homoptera: Psyllaae] Infesting Ten Olive Cultivars in the Southern Highlands of West-Bank, Palestine

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Abstract

This study was conducted in Al-Arroub agricultural experimental station, during 2013 season, to monitor the seasonal flight activity of the *Eupyllura olivina* [Homoptera: Psyllaae] in the southern highlands of Palestine using four sticky colored traps. The study also aims to evaluate the effect of olive cultivar on the population dynamics of olive psylla. Throughout this research, it was clear that flight activity as well as insect infestation by *E. olivina* began in early April and continued until the end of September with its peak of activity in mid of May. Results also confirmed that, the sticky yellow traps were more effecient in captuering *E. olivina* than other colored sticky traps. Moreover, variation in the susceptability of different olive cultivars was demonstrated among the ten examened olive cultivars.

Keywords: *Eupyllura olivine*; flight activity; population dynamics; olive cultivar susceptibility.

1. Introduction

Olive (*Oleae europaaea* L.) is one of the most important fruit trees in Palestine. The number of olive trees reached 11.3 million trees in Palestine, cultivated in an area of 45,140 hectares, and constituted about 67% of the total planted area with fruit trees in Palestine [1].

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Olive psylla, *Euphyllura. olivina* is one of the most dangerous pests that affected olive trees in the Mediterranean basin. Olive psylla, *E. olivina* was reported as one of the most important pests of olive trees in Palestine [2]. Nymphs were recorded under large amounts of white wax covering on olive florescence, and adults observed emerging in March and April in accordance with temperature and humidity degrees.

In Jordan, author [3] investigated the factors affecting the distribution of *E. olivina* on olive in Jordan, and reported that, nymphal infestation was mainly found close to the fruits and the adult population of *E. olivina* showed two generations annually in mid-May and in end June,1984, and the summer generation caused a significant economic loss to olive fruit. Later on author [4] also reported that, the overwintering adults laid eggs from mid-November up to early April, 1989; emerging adults of the spring generation showed a peak in early May and, another peak for adults in summer generation between late June and early July.

In Tunisia, author [5] reported *E. olivina* among the harmful pests of olive trees that caused serious damage on young shoots and flower clusters of olive plants in Sfax region.

In Iran, author [6] studied the life table parameters of olive psylla infesting four different olive cultivars and concluded that, the development, reproduction and growth population parameters of the olive psylla, *Euphyllura pakistanica* were significantly influenced by olive cultivars.

This study was conducted in the olive grove of Al-Arroub agricultural experimental station that include ten olive cultivar to monitor the flight activity of olive psylla, *E. olivina* and to record its population dynamics using ten different olive cultivars in Palestine.

2. Materials and Methods

This study was conducted in an olive grove about 50 years old in Al-Arroub agricultural experimental station in the southern high lands of Palestine. The olive groove includes four terraced blocks, planted with 10 olive cultivars including Nabaly-Mohasen; Nabaly-Balady; Tell; Nasohi-Gaba; Sevelano; Balady; Grosya-Deponia; Telmesane; Kalamata and Manzanilo.

2.1. Monitoring flight activity of E, olivina

To monitor the flight activity of olive psylla, traps were used from 1st April 2013 until 30th September 2013. Four sticky colored traps (Blue, Green, Red and Yellow) were used (Fig. 1). Each trap included colored sticky rectangular board with 15*25 cm dimension. One side of the trap was painted with a sticky adhesive paste (Rinifoot, Polisobutene 80% PA).

The traps were randomly distributed in each block of the olive grove and hanged at a height of 1 to 2 m on olive trees. The sticky boards were weekly changed, and took to the laboratory where the trapped olive psylla were counted under binocular microscope.

2.2. Recording the population dynamics of E. olivina

Infestation data was recorded on 16 olive trees that were also used for monitoring the flight activity. At each chick (on the date of monitoring), five branches 20-25 cm length were randomly selected from the four sides and center of the selected olive tree and used to record the olive psylla infestation. Those branches were shocked inside a paper bag and the paper bags took back to the laboratory where the collected olive psylla counted and recorded under binocular microscope.

Figure 1: Sticky colour traps (Blue, Green, Red, and Yellow)

3. Results

3.1. Effect of color of the sticky trap on it's efficiency in attracting and capturing the olive psylla, Euphylura olivina:

Results presented in Table (1) show the means of the total olive psylla that were captured/sticky trap during the experiment. The sums of 187 olive psylla were trapped/yellow trap; 34.25/green trap; 25/blue trap and 9.75 /red trap. It's concluded that yellow traps were significantly highest in attracting the adult olive psylla than any of the other used color traps.

Table 1: Mean number of adult olive psylla that was captured/colour trap/month during 2013 in Al-Arroub agricultural experimental station. Mean* ± s.e

Date	Blue	Green	Red	Yellow	P value**
April	1.75b±2.7	6.5b±4.1	1.75b±1.7	54.5a±44.7	0.016
May	4.25b±5.	19b±9	5.5b±3.1	88a±26.2	0.000
June	2.5b±1.7	3.25b±1.9	8.5b±5.9	32a±20.8	0.007
July	0.25b±.5	1b±1.4	4.5ab±1.3	7a±3.6	0.002
Aug	0.25b±.5	2ab±1.4	4.25a±1.3	2.75ab±1.5	0.005
Sept	0.75a±.9	2.5±1.7	0.5±2.2	3.25±2.3	0.6NS
Total	9.75b±9	34.25b±9.6	25b±9.9	187.5a±50.2	0.000

*: Means within the same row with different letters significantly differ at P value ≤0.05 (Using Fisher's pairwise comparisons).

**: NS=Not significant at P value ≥ 0.05 (Using Fisher's pairwise comparisons)

3.2. Seasonal flight activity of E. olivina in the southern highlands of Palestine during 2013 season:

Results presented in (Fig 2) show the flight activity of *E. olivina* in Al-Arroub agricultural experimental station during 2013 season. It was found that *E. olivina* started its seasonal flight activity in Al-Arroub at the beginning of April, and then continued until late of September with its peak of flight activity at mid of May 2013.

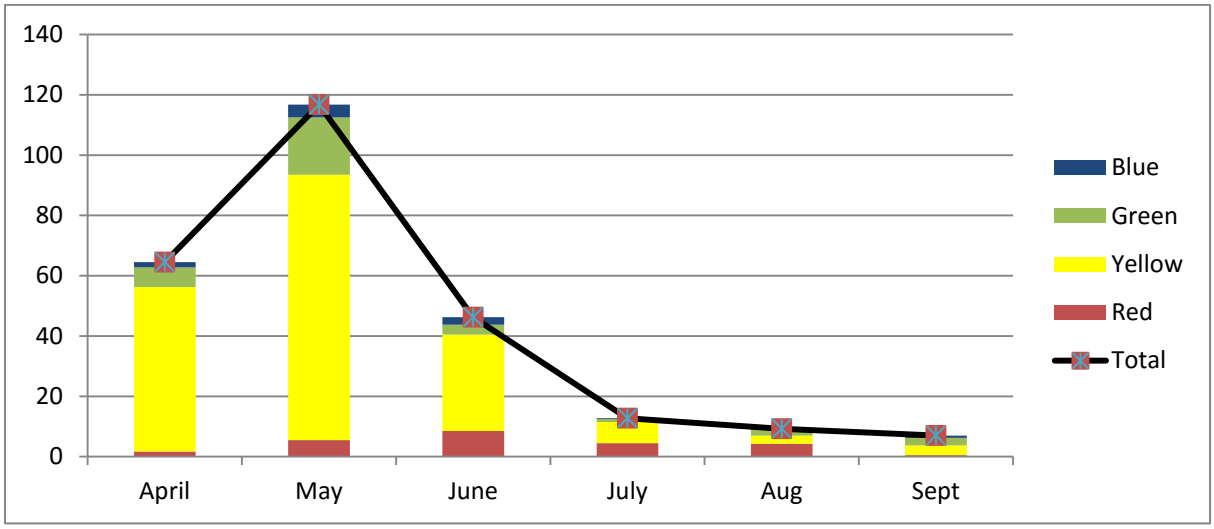

Figure 2: Flight activity of olive psylla recorded in Al-Arroub agricultural experimental station 2013.

3.3. Population dynamics of olive psylla, Euphylura olivina in the southern highlands of Palestine during 2013 season:

The results in this section illustrate the population dynamics of *E. olivina* in Al-Arroub agricultural experimental station during 2013 season. Results presented in Fig (3) show that, the psylla infestation started on the early of April and continued up to harvesting at the end of September 2013, with its peak of infestation at the mid of May coinciding with its peak of flight activity.

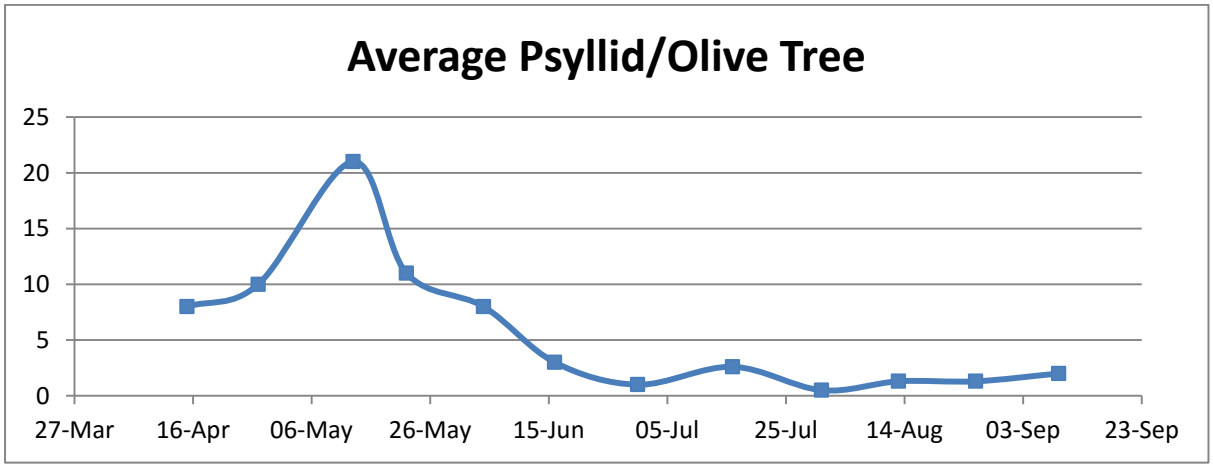

Figure 3: Rate of infestation of olive psylla in Al-Arroub Agricultural Experimental Station, 2013.

3.4. Susceptibility of olive cultivars to psylla infestation

Results in Figure 4, illustrate the rate of psylla infestation on 10 different olive cultivars in Al-Arroub agricultural experimental station during 2013 season. Results show that the rate of psylla infestation was significantly affected by the cultivar of the olive trees. Thus, Balady was significantly the highest susceptable olive cultivar to olive psylla infestation with mean total of 249 psylla/olive tree; followed by Grosya Deponia cultivar ith 196 psylla/tree and Sevelano cultivar with 161 psylla/tree. However, the other cultivars showed low susceptability to olive psylla infestation and the mean total numbers of psylla recorded on these cultivars were 55 psylla /tree on Nasohi Gaba; 48 on Kalamata cultivar; 37 on Tell cultivar; 35 on Nabaly Mohasen cultivar; 33 on Telmesani cultivar; 18.6 on Nabaly Baladi and the least rate of psylla infestation was recordrd on Manzanilo cultivar with 6 psylla/tree.

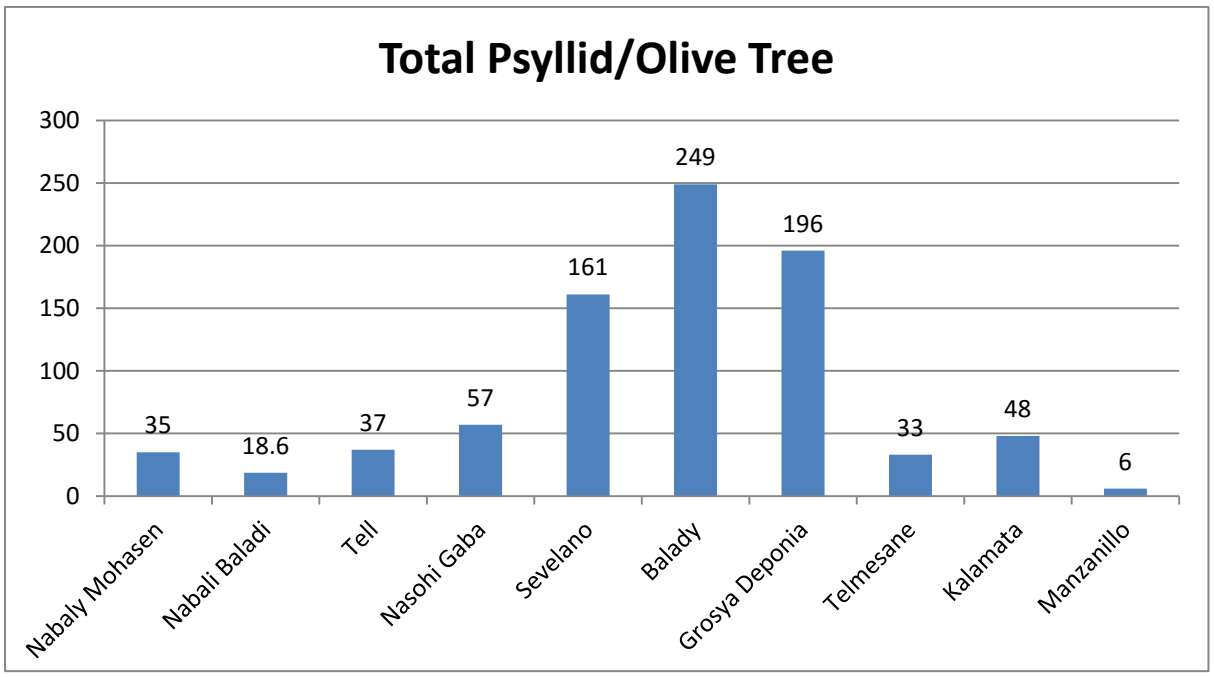

Figure 4: Rate of infestation of olive psylla recorded on 10 olive cultivars in Al-Arroub Agricultural Experimental Station during 2013 season.

In conclusion, same trend of susceptability was observed on the rate of establishment of infestation that was recorded at early of April with significantly highest record of psylla on three olive cultivars including Balady; Grosya Deponia and Sevilano and low rate of infestation on all other investigated cultivars (Table 2).

4. Discussion

4.1. Flight activity of Euphylura olivina

Results of the present study showed that throughout 2013 season, the seasonal flight activity of *E. olivina* started in early April, and continued its activity throughout the season till the end of September 2013. Present study also demonstrated one peak of flight activity of *E. olivina* occurred at the mid of May.

Table 2: Mean number of olive psylla/tree recorded infested ten olive cultivars in Al-Arroub Agricultural Experimental Station during 2013 season.

Date	Nabaly Mohasen	Nabaly Balady	Tell	Nasohi Gaba	Sevelano	Balady	Grosya Deponia	Telmisane	Kalamata	Manzanillo	*P value*
15-4-13	0b	0.6.7b	0b	2.333b	34a	35a	31a	2b	1b	1b	0.001
27-4-14	2c	1.6c	1c	0.667c	14bc	22b	80a	9c	6c	0c	0.001
13-5-13	0b	3.2b	1b	22b	55ab	120a	20b	3b	30b	0b	0.018
22-05-13	9	4.8	6	14	11	3	50	10	1	0	0.477NS
04-06-13	11b	0.4b	0b	9.333b	18ab	50a	5b	1b	2b	1b	0.047
16-06-13	3b	2.4	11a	1b	10a	5ab	1b	5ab	0b	0b	0.041
30-06-13	1	0.4	1	2	2	3	1	0	0	1	0.822NS
16-07-13	3	1.4	6	1.333	8	7	2	0	0	0	0.133NS
31-07-13	1	0.4	0	0.333	1	0	0	0	3	0	0.104NS
13-08-13	1	1.4	3	0	2	1	0	2	3	0	0.57NS
26-08-13	3	0.6	3	0.333	2	3	2	0	0	1	0.092NS
09-09-13	1	1.4	5	0.667	4	0	4	1	2	2	0.532NS
Total	35b	18.6b	37b	57b	161ab	249a	196ab	33b	48b	6b	0.035

*: Means within the same row with different letters significantly differ at P value ≤0.05 (Using Fisher's pairwise comparisons)

**: NS=Not significant at P value ≥ 0.05 (Using Fisher's pairwise comparisons).

In addition, this research confirmed that throughout the season, the sticky yellow traps were the most efficient in capturing *E. olivina* than the green; red and blue traps.

Those results are similar to that concluded by author [3, 4, & 7] in Jordan who reported two generations of olive psylla in Jordan groves: author [3] recorded spring generation with its peak of adult activity occurred in the med of May followed by summer generation with its peak of adult activity between late June and early July. In addition, author [8] reported the emergence of *E. olivina* as a new pest in Terceira Island in the beginning of June 2008, and they registered two generations: one at the beginnings of June and the other at the endings of October.

4.2. Population dynamics of Euphyllura olivina on different olive cultivars

Results of the present study demonstrated the relationships between rate of fruit infestation; flight activity of *E. olivina* and the environmental conditions throughout the 2013 growing seasons. Thus, results concluded that positive relationships were recorded between the rate of psylla infestation and its flight activity.

Furthermore, present study demonstrated the variation in attractiveness and susceptibility of 10 olive cultivars to olive psylla. Balady; Grosya Deponia and Sevilano showed high attractiveness and susceptibility to olive psylla infestation meanwhile Nasohi Gaba; Kalamata; Tell and Nabaly Mohasen cultivar showed medium susceptability to olive psylla and Telmesani; Nabaly Baladi and Manzanilo cultivars were the lowest in susceptability to olive psylla.

Semilar results were concluded by author [6] whom reported thtat life table parameters of olive psylla were significantly affected by the different olive cultivars in Iran. They found that, the development and demographic parameters of olive psylla were influenced by different cultivars and that effect was suggested to morphological and biochemical mechanisms that may be involved in the defense strategies of olive trees against this olive psylla.

Furthermore, author [5] concluded that, the impact of the two growth conditions on psylla population was different and related that effect to the accelerated floral and vegetative growth of the tree in addition to the excessive humidity under intensive system in comparison with the extensive system in Tunisia.

5. Conclusions

Throughout this research, following conclusions were recorded:

1. The seasonal flight activity of *Eupyllura olivina* in the southern highlands of Palestine started in early April, and continued its activity throughout the season till the end of September with its peak of flight activity at the mid of May.
2. Significant differences in rate of *Eupyllura olivina* infestation were recorded between the olive cultivars.
3. Nabaly Baladi and Manzanilo cultivars were the lowest in susceptability to olive psylla.
4. Yellow sticky traps are the most efficient in capturing *E. olivina* than the green; red and blue traps.

Acknowledgements

This is to thank National Agricultural Research Center (NARC)/ Palestinian Ministry of Agriculture for their cooperation in conducting this study in the olive grove in Al-Arroub Agricultural Experimental Station.

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